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EXAMINER

BERDICHEVSKY, MIRIAM

ART UNIT	PAPER NUMBER
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1795

NOTIFICATION DATE	DELIVERY MODE
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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

Office Action Summary	Application No. 10/509,935	Applicant(s) SARICIFTCI ET AL.	
	Examiner MIRIAM BERDICHEVSKY	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 November 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 12-19 and 22-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12-19, 22-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/22/2008 has been entered.

Remarks

Claims 19 and 24 are amended. Claims 1-10, 12-20 and 22-24 are currently pending.

Status of Objections and Rejections

The rejection of claims 19-20 and claims 22-24 from the previous office action is withdrawn in view of Applicant's amendments. New grounds of rejection under 35 U.S.C 103(a) are necessitated by the amendments.

All other rejections from the previous office action are maintained.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-10, 12-19 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cravino (as cited in the IDS) in view of Sentein (as cited in the IDS) and in view of Zhao (as cited in the IDS) with supporting evidence provided by Dittmer (*Electron Trapping in Dye/Polymer Blend Photovoltaic Cells*) and further in view of Gebeyehu (*Characterization of large area flexible plastic solar cells based on conjugated polymer/fullerene composites*).

As to claims 1, 10, 19 and 24, Cravino teaches a photovoltaic cell comprising,

- A photoactive region and two metal electrodes (p-type/n-type between anode and cathode, Figure 1),
- The photoactive layer comprising a conjugated polymer component (electron donor) and a fullerene component (electron acceptor) (section 5, ¶ 1), and
- The two metal electrodes provided on either side of the photoactive layer (p- type/n-type between anode and cathode, Figure 1).

Cravino is silent to a method for the post treatment of a photovoltaic cell comprising:

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- Subjecting the photovoltaic cell to heat treatment above a glass transition temperature of the conjugated polymer for a predetermined treatment time,
- The heat treatment of the photovoltaic cell being carried out for at least a portion of the treatment time under the influence of an electric field induced by a field voltage applied to the electrodes of the photovoltaic cell and exceeding a no-load voltage thereof.

Sentein teaches a method for the post treatment of a photovoltaic cell comprising:

- Subjecting the photovoltaic cell to heat treatment near a glass transition temperature of the conjugated polymer for a predetermined treatment time (section 1, ¶ 2),
- The heat treatment of the photovoltaic cell being carried out for at least a portion of the treatment time under the influence of an electric field induced by a field voltage applied to the electrodes of the photovoltaic cell and exceeding a no-load voltage thereof (section 1, ¶ 2; section 5, ¶ 1).

Where 5 to 10 V clearly exceeds a no-load voltage.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the fullerene/polymer system of Sentein in Carvino because fullerenes have an extended delocalized π -electron source and lead to the cost effective fabrication of flexible large area solar cells, as taught by Sentein (section 1, ¶ 1).

Neither Cravino nor Sentein teach the heat treatment being above a glass transition temperature of the conjugated polymer.

Zhao teaches a heat treatment being above a glass transition temperature (T_g) of the conjugated polymer (Results section, ¶ 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Cravino and Sentein by increasing the heating temperature to above the T_g of the conjugated polymer as taught by Zhao because an enhanced crystallization of the polymer can be obtained, as taught by Zhao (Results section, ¶ 4), along with this enhanced crystallization comes increases in hole mobility as seen by the supporting evidence provided by Dittmer (page 1273, ¶ 1).

Cravino, Sentein and Zhao are silent to the conjugated polymer (donor) and fullerene (acceptor) being different compounds.

Gebeyehu teaches the use of conjugated polymer and fullerene composites which are favorably tuned by an electric field (section I, ¶ 4 and section 2, ¶3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the separate fullerene (acceptor) and conjugated polymer (donor) of Gebeyehu in modified Cravino because these systems are based on ultrafast, reversible, metastable photoinduced electron transfer and charge separation, as taught by Gebeyehu (abstract).

Further regarding claim 19, neither Cravino nor Sentein explicitly teach that the invention is subjected for between 2 and 8 min (claim 19); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 19) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6) and as seen in Zhao (10 min) (experimental, ¶ 1).

Further regarding claim 24, the reference teaches simultaneously injecting charge carriers into the photovoltaic cell via at least one electrode selected from the group consisting of the first and second electrode. Application of the field will inherently, inject charge carriers.

Regarding claim 2, modified Cravino teaches that the electric field is induced via a field voltage that exceeds the no-load voltage of the photovoltaic cell by at least 1 V (Sentein: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

Regarding claim 3, neither Cravino nor Sentein explicitly teach application of a field voltage between 2.5 and 3 V.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply a voltage between 2.5 and 3 V, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the current/voltage experiments were performed for a broad range of values as seen in Sentein (Figure 5).

Regarding claim 4-9, neither Cravino nor Sentein explicitly teach that the invention as to claim 1 or claim 2 or claim 3 is subjected for between 2 and 8 min (claims 4-6) or between 4 and 5 min (claims 7-9); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 4-6) or between 4 and 5 minutes (claims 7-9) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6) and as seen in Zhao (10 min) (experimental, ¶ 1).

Regarding claim 12, Cravino and Sentein are silent to heating above a glass transition temperature of the electron donor.

Zhao teaches heating above a glass transition temperature of the electron donor (conjugated polymer) (Results section, ¶ 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to increase the heating temperature to above the T_g of the conjugated polymer as taught by Zhao because an enhanced crystallization of the polymer can be obtained, as taught by Zhao (Results section, ¶ 4), along with this enhanced crystallization comes increases in hole mobility as seen by the supporting evidence provided by Dittmer (page 1273, ¶ 1).

Regarding claim 13, the reference teaches that the electric field is formed by applying a field voltage to the first and second electrodes (Sentien: section 2, ¶ 3).

Regarding claim 14, the reference teaches that the electric field exceeds a no-load voltage of the photovoltaic cell (Sentien: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage because the open current voltage of single junction cells are typically of the order of 1 V or less.

Regarding claims 15 and 22, the reference teaches that the electric field exceeds the no-load voltage by at least 1 V (Sentien: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

Regarding claim 16, Sentein suggests application of a field voltage between 2.5 and 3 V.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply a voltage between 2.5 and 3 V, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the current/voltage experiments were performed for a broad range of values as seen in Sentein (Figure 5).

Regarding claims 17-18, Sentein and Zhao teach that the photovoltaic cell is subjected for between 2 and 8 min (claim 17) or between 4 and 5 min (claims 18); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes

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(claim 17) or between 4 and 5 minutes (claim 18) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6) and as seen in Zhao (10 min) (experimental, ¶ 1).

Regarding claim 20, Cravino teaches that the photoactive layer comprises an electron donor and an electron acceptor (section 2, ¶ 1).

Regarding claim 22, Cravino teaches that the electric field exceeds the no-load voltage by at least 1 V (Sentein: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

Regarding claim 23, Sentein teaches that the photovoltaic cell is subjected for between 4 and 5 min (claim 23); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 4 and 5 minutes (claim 23) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6) and as seen in Zhao (10 min) (experimental, ¶ 1).

Response to Arguments

4. Applicant's arguments with respect to claims 19 and 24 have been considered but are moot in view of the new ground(s) of rejection as necessitated by amendment.

5. Applicant's arguments regarding claim 1 filed 11/25/2008 have been fully considered but they are not persuasive. In response to applicant's argument that Sentein is nonanalogous art because Sentein is drawn to a push-pull (tethered donor acceptor molecule) while the instant claims are drawn to separate donor and acceptor molecules, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, both the instant claims and Sentien are drawn to photovoltaic cells (Sentien: section I). Sentien teaches that use of a heat treatment and electric field treatment to rectify and orient polar molecules (section II) as a method of reducing potential barriers for charge injection and extraction at the electrodes (section V). One of ordinary skill in the art would appreciate that although Sentien specifically discloses a push-pull molecule, Sentien refers to the orienting molecule generally as polar molecules. Therefore, it would have been obvious to try heat/electric field treatment of separate molecules (as modified with Gebeyehu) because Sentien teaches one of ordinary skill in the art the general concept of orienting active polar polymers for use in solar cells to be advantageous. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references

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individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicant argues that Gebeyehu does not teach subjecting the cell to an electric field. The Examiner notes that Sentien is relied upon for the electric field treatment limitation while Gebeyehu is relied upon for teaching the use of separate donor and acceptor layers which are favorably responsive to an electric field. Finally, in response to applicant's argument that the examiner has combined an excessive number of references, reliance on a large number of references in a rejection does not, without more, weigh against the obviousness of the claimed invention. See *In re Gorman*, 933 F.2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991).

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **MIRIAM BERDICHEVSKY** whose telephone number is (571)270-5256. The examiner can normally be reached on M-Th, 10am-8pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./
Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795